

GSI Environmental Inc. Expert



John A. Connor, P.E., P.G., B.C.E.E.

- **Education:**

B.A., Stanford University

M.S., Stanford University

- **General Experience:**

34 years, focus in environmental investigation, groundwater protection, risk assessment, remediation, oil and gas operations.

- **Oilfield Experience:**

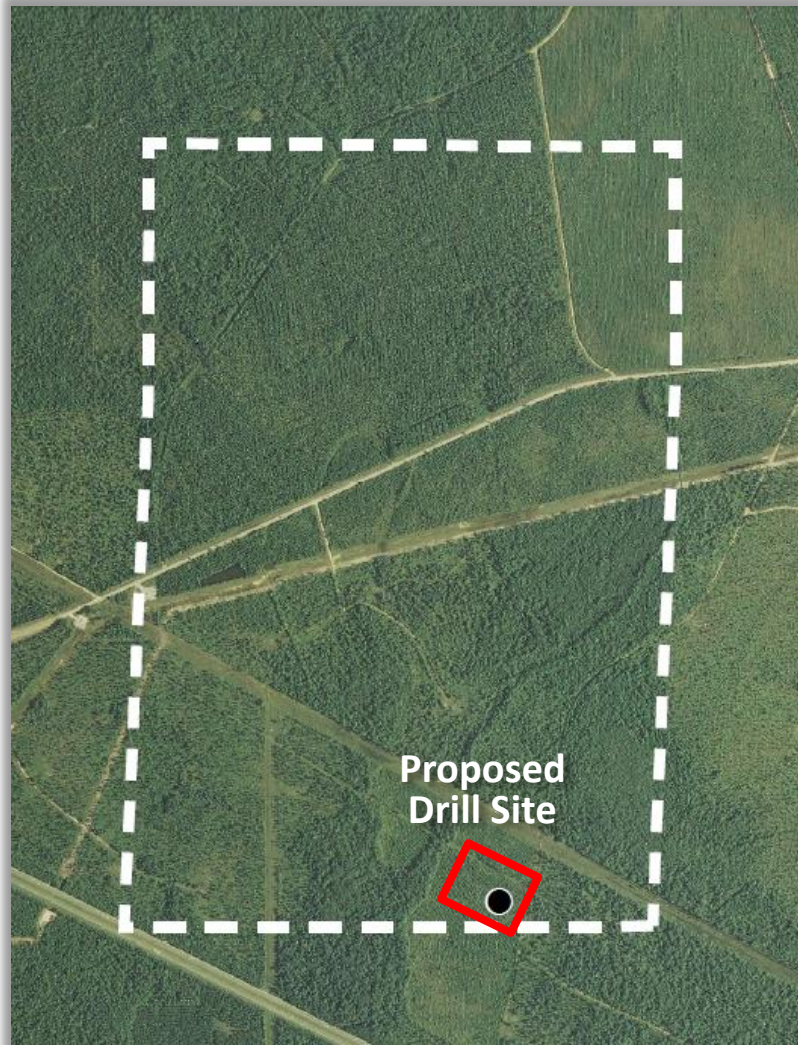
Environmental audits, risk assessment, technical guidance documents, environmental research and development studies, remediation methods and costs.

American Academy of



**Environmental
ENGINEERS**

Environmental Issues Reviewed

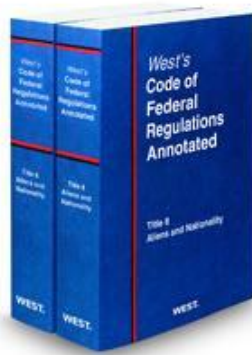


- Considerations for site selection
- Groundwater protection
- Water use
- Spill prevention/stormwater management
- Ecology and wetlands
- Air monitoring
- Emergency response
- Miscellaneous: noise, traffic, etc.

Relevant Regulations and Technical Guidelines



- **Louisiana Administrative Code**
 - Title 33, 43 (29-B)



- **Code of Federal Regulations**
 - Title 29, 33, 40



- **American Petroleum Institute
Guidance on Hydraulic Fracturing**

Environmental Engineering Review

- **Helis' Operational History**

- **Water Supply**

- **Chemical Disclosure**

- **Groundwater Protection**

- **Waste Management and
Other Environmental Issues**

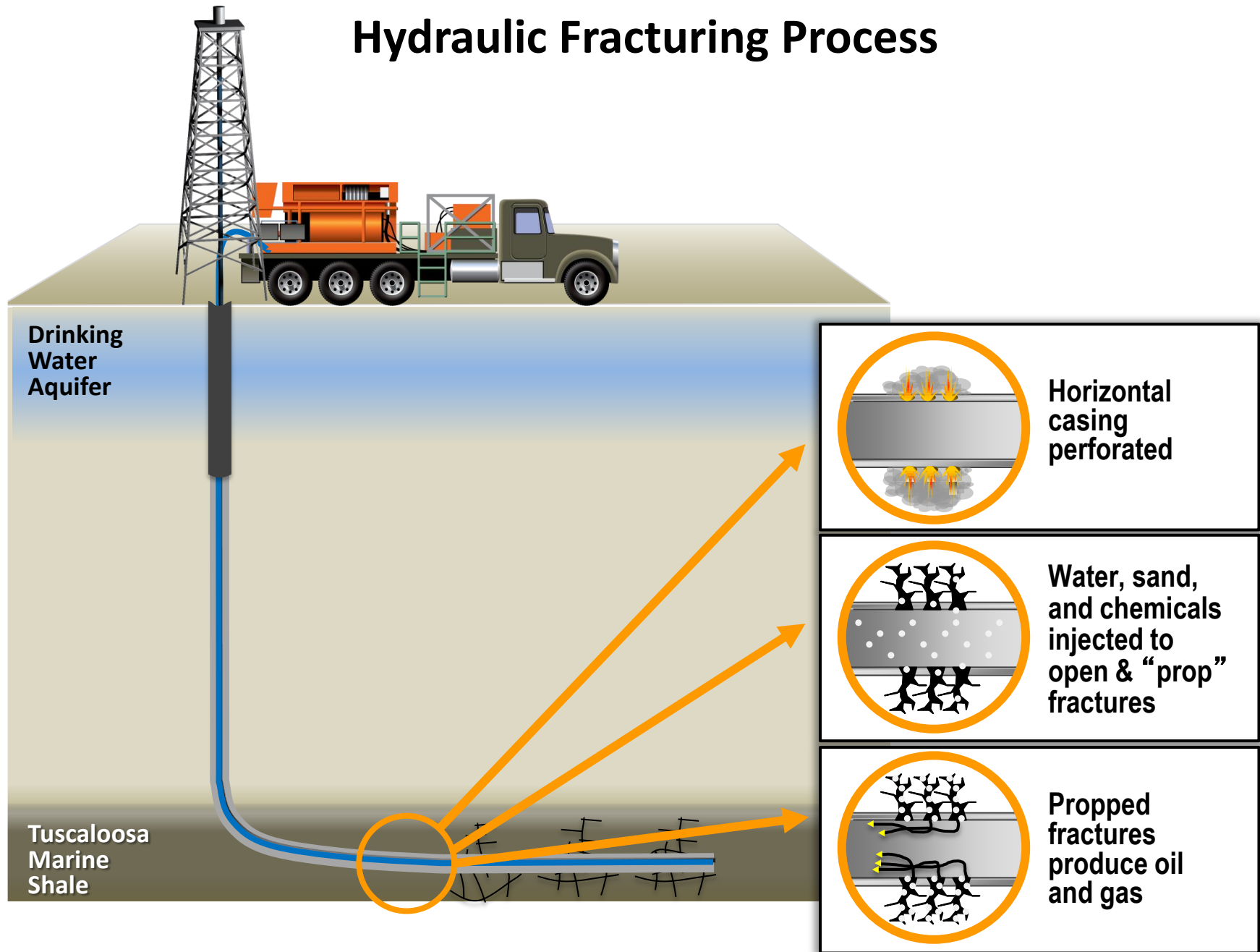
Helis' Operational History



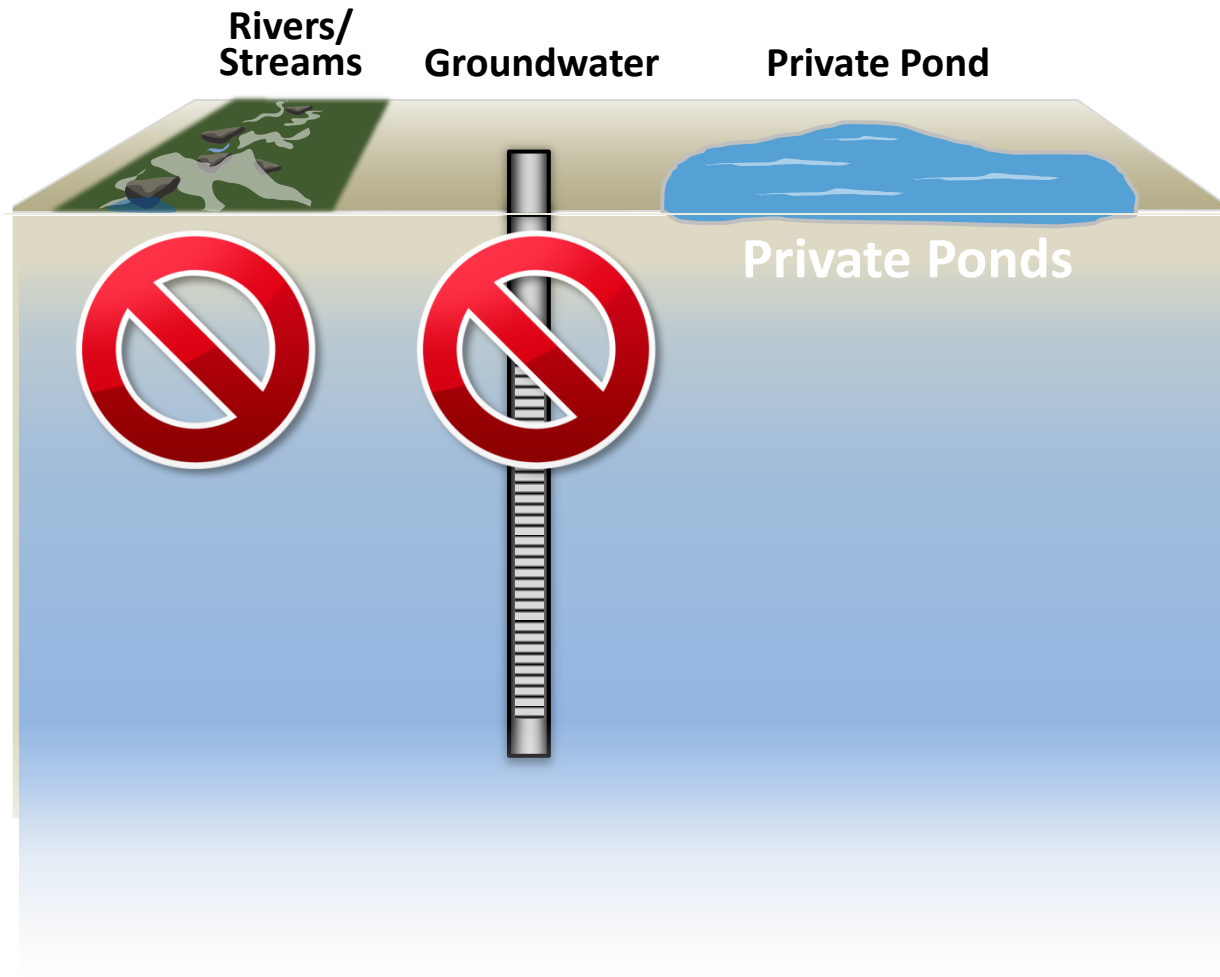
- Louisiana company, founded **80** years ago
- Helis currently operates over **100** wells in Louisiana
- Over **900** regulatory inspections, since 2006 alone
- Only 11 issues, none environmental
- all resolved

Helis has drilled over **650** wells in the U.S.

Hydraulic Fracturing Process

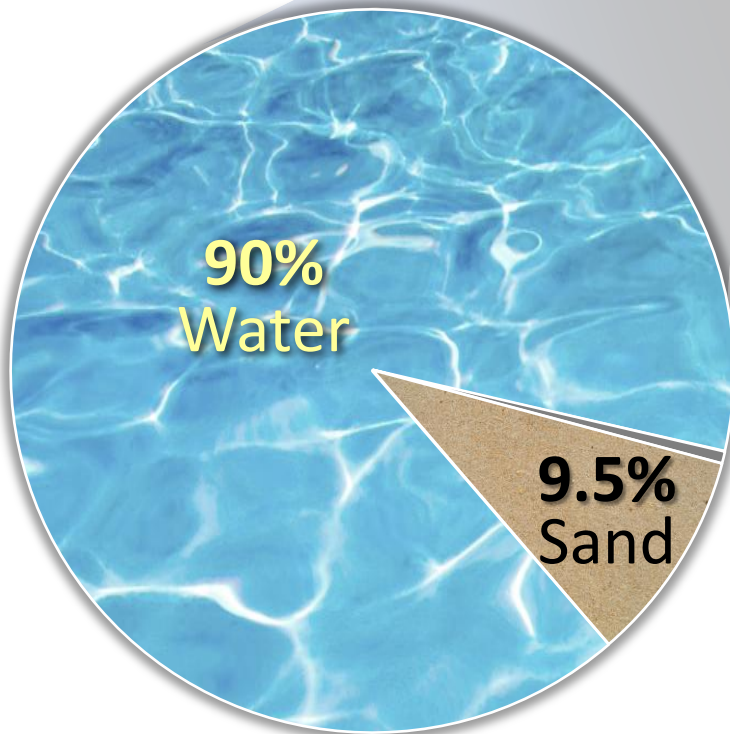
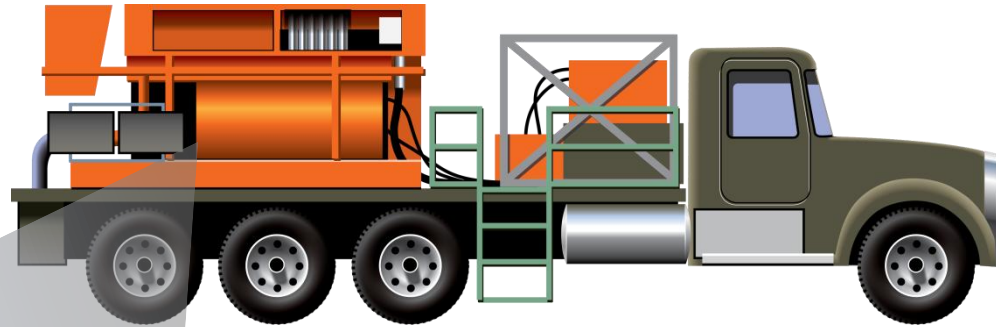


Where Will Helis Get Their Water For This Site?





- For this well, Helis will use water from private ponds
- Nearest scenic stream (Cane Bayou) is approximately 0.9 miles away – will not be used

What Is In The Hydraulic Fracturing Mixture?



0.5%
Chemical
additives

What Are These Chemical Additives?



HYDRAULIC FRACTURING
HOW IT WORKS

Why Chemicals Are Used

Given today's technology, chemicals must be used in hydraulic fracturing to ensure the producing format fracturing chemical usage including the types of chemicals, their uses in the process and the result of the

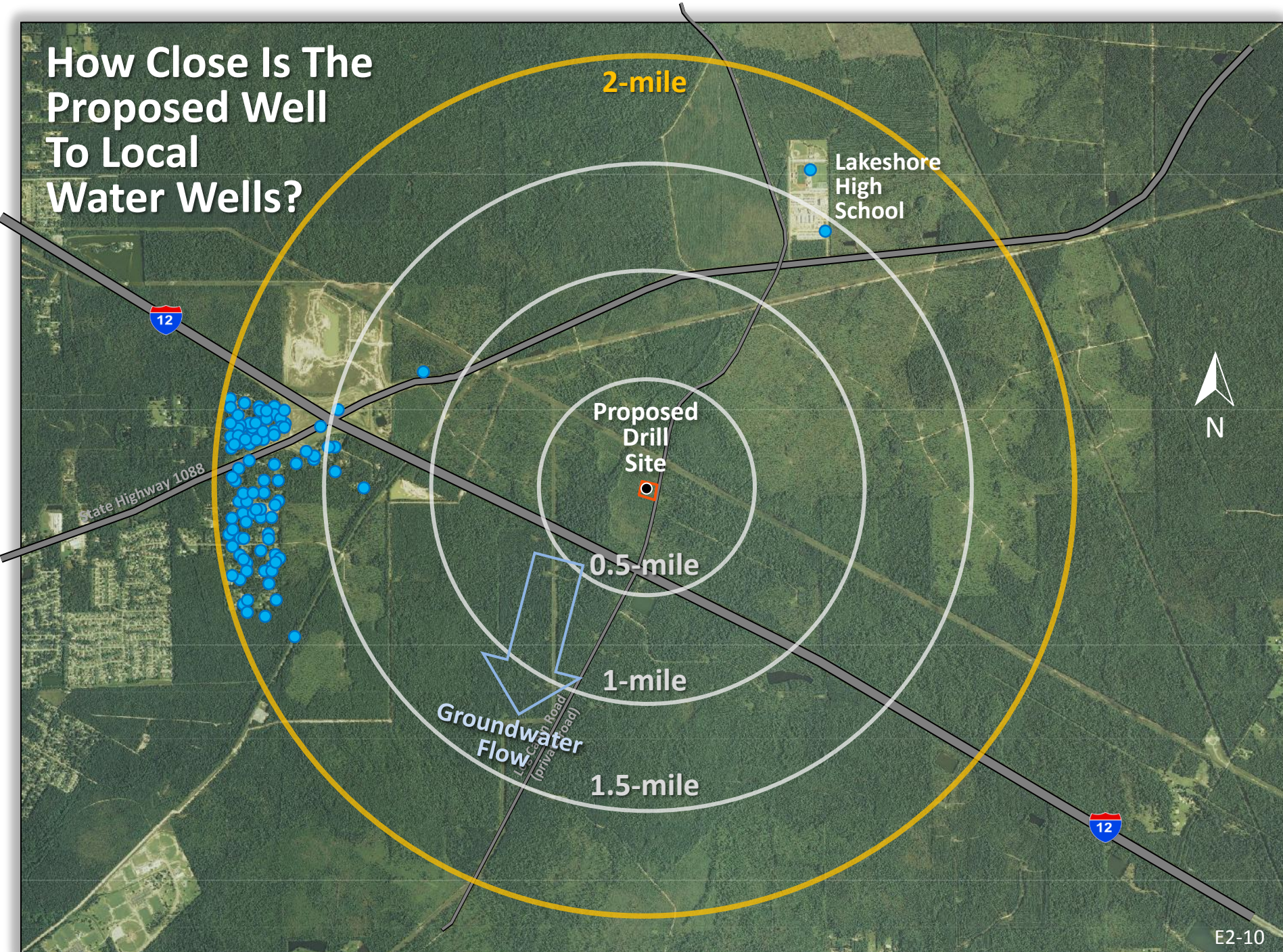
Additive	Purpose
Acid	Helps dissolve minerals and initiate cracks in the rock
Acid/Corrosion Inhibitor	Protects casing from corrosion
Biocide	Eliminates bacteria in the water that can cause corrosive by products
Base Carrier Fluid (water)	Create Fracture Geometry and Suspend Proppant
Breaker	Allows a delayed break down of gels when required.
Clay and Shale Stabilization/control	Temporary or Permanent Clay Stabilizer to lock down clays in the shale structure
Crosslinker	Maintains viscosity as temperature increases
Friction Reducer	Reduces Friction effects over base water in pipe
Gel	Thickens the water in order to suspend the proppant
Iron Control	Iron chelating agent that helps prevent precipitation of metal oxides
Non-Emulsifier	Used to break or separate oil / water mixtures (emulsions)
pH Adjusting Agent/Buffer	maintains the effectiveness of other additives such as crosslinkers
Propping Agent	Keeps Fractures Open allowing for hydrocarbon production
Scale Inhibitor	Prevent Scale in Pipe and Formation
Surfactant	Reduce Surface tension of the treatment fluid in the formation and helps improve fluid recovery from the well after the frac is completed

- Chemicals used at each site vary.
- Helis will disclose chemicals used at this site on **Frac Focus**.
- Helis' chemical disclosure policy: *Full disclosure without trade secrets.*

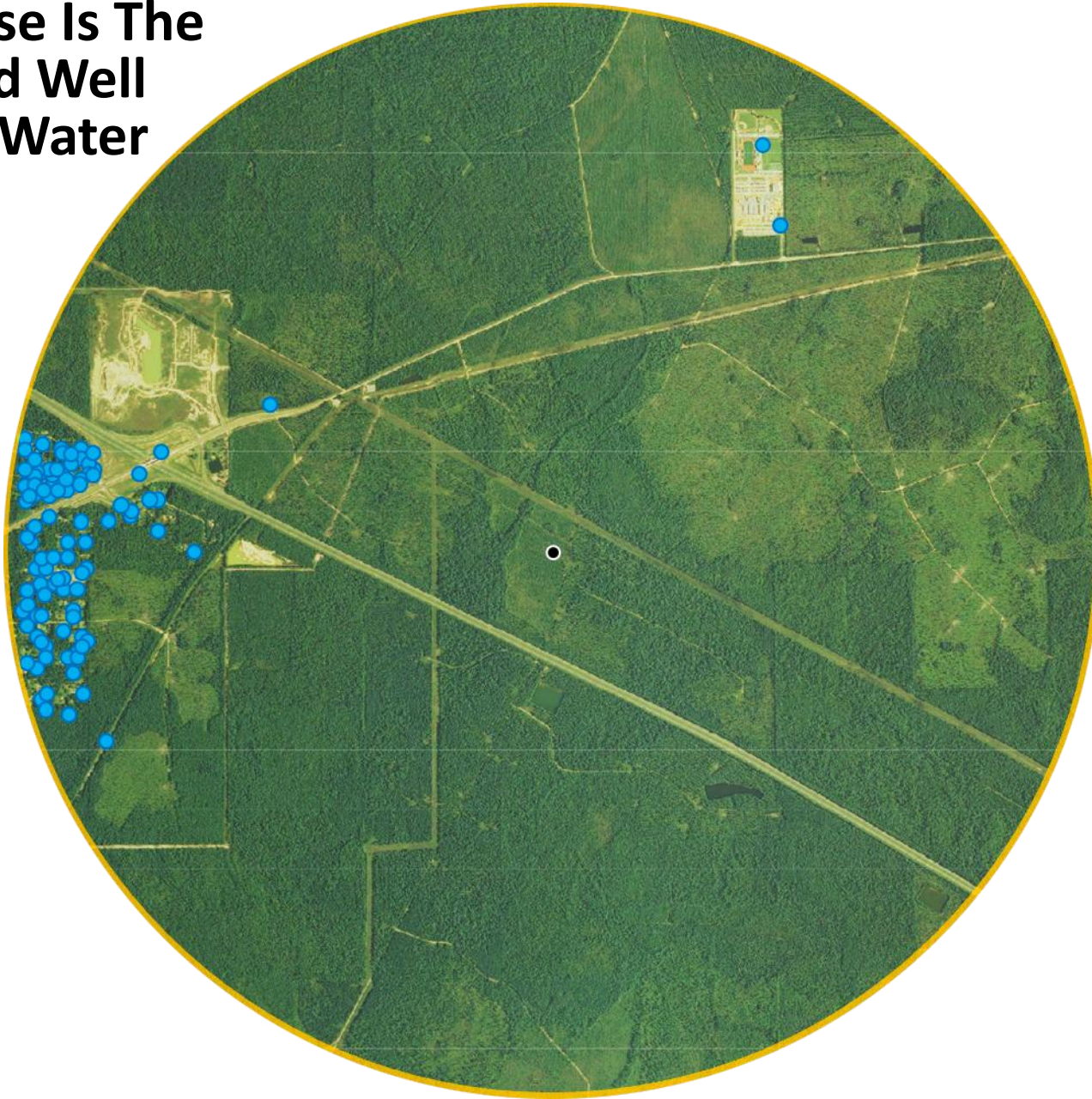


<http://fracfocus.org/>

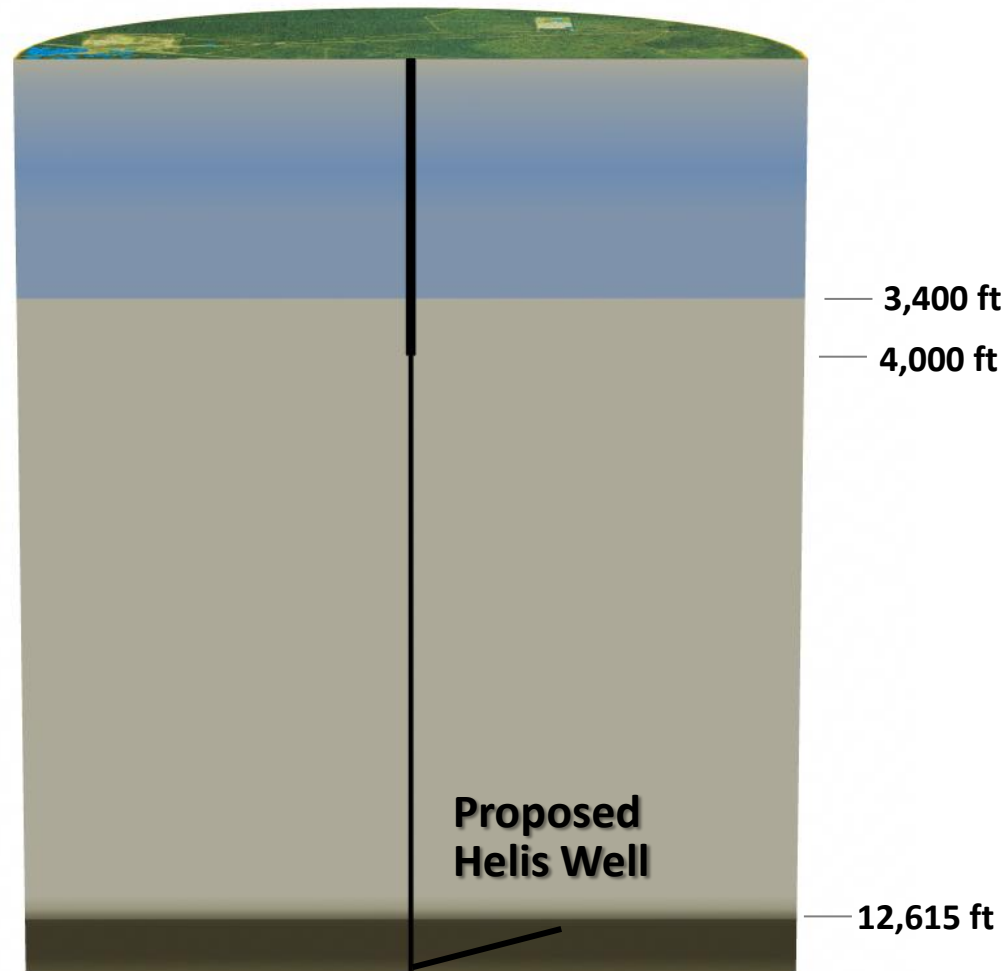
How Close Is The Proposed Well To Local Water Wells?



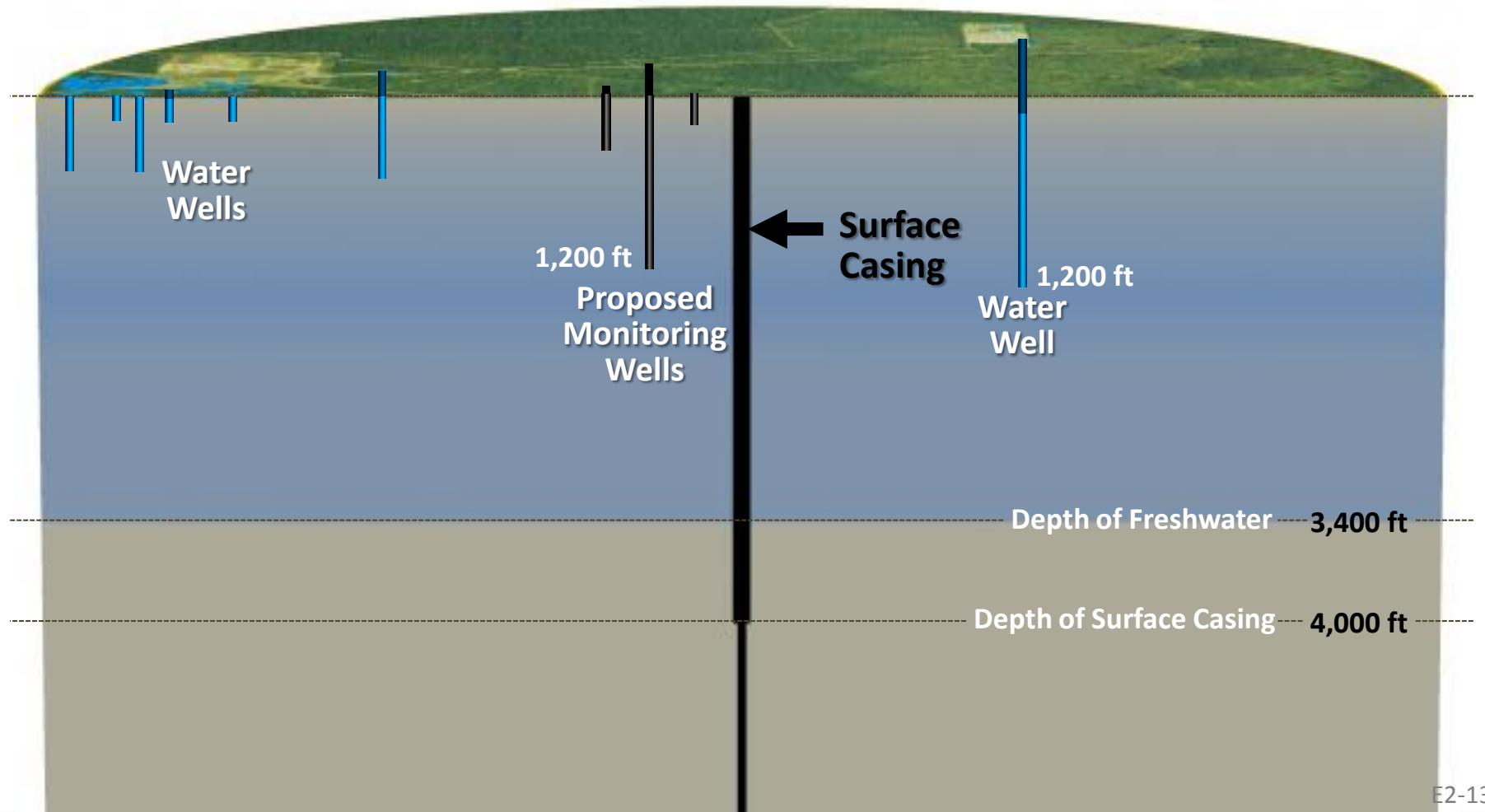
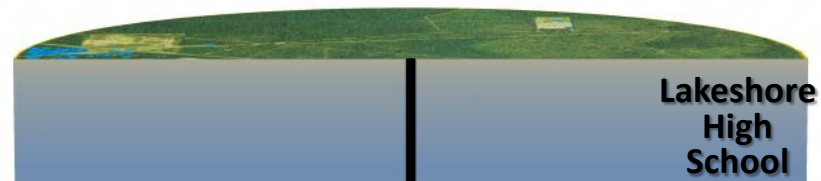
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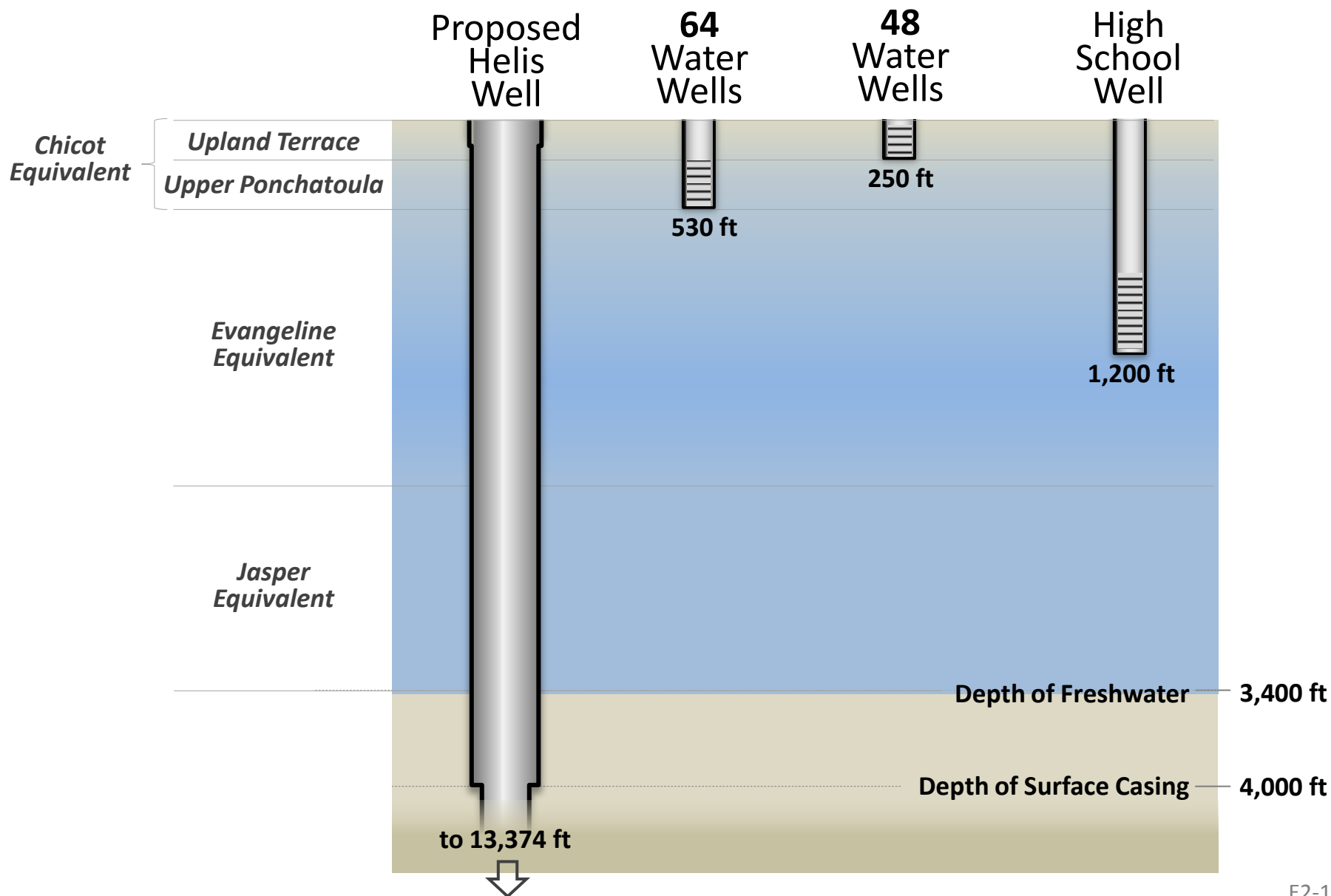
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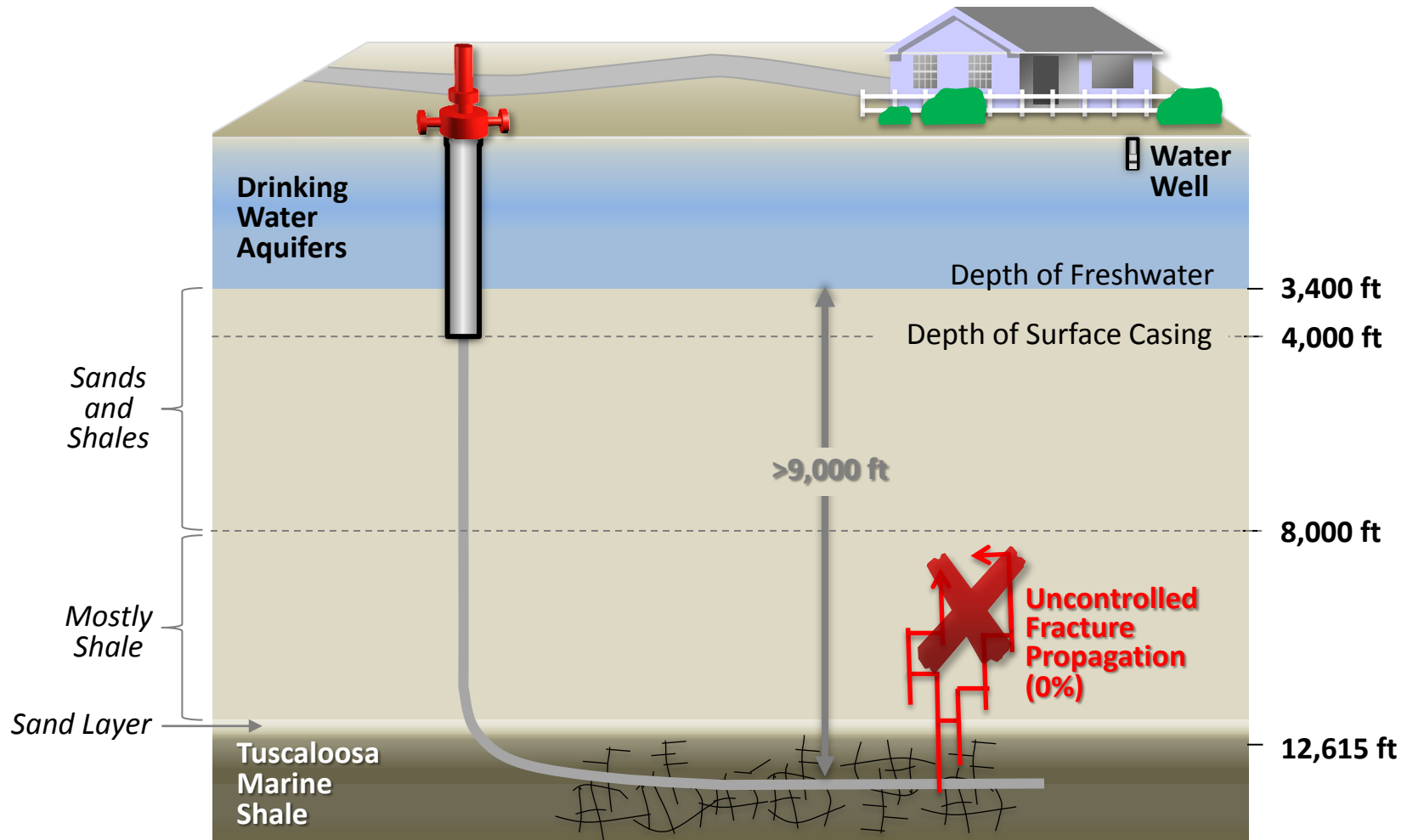
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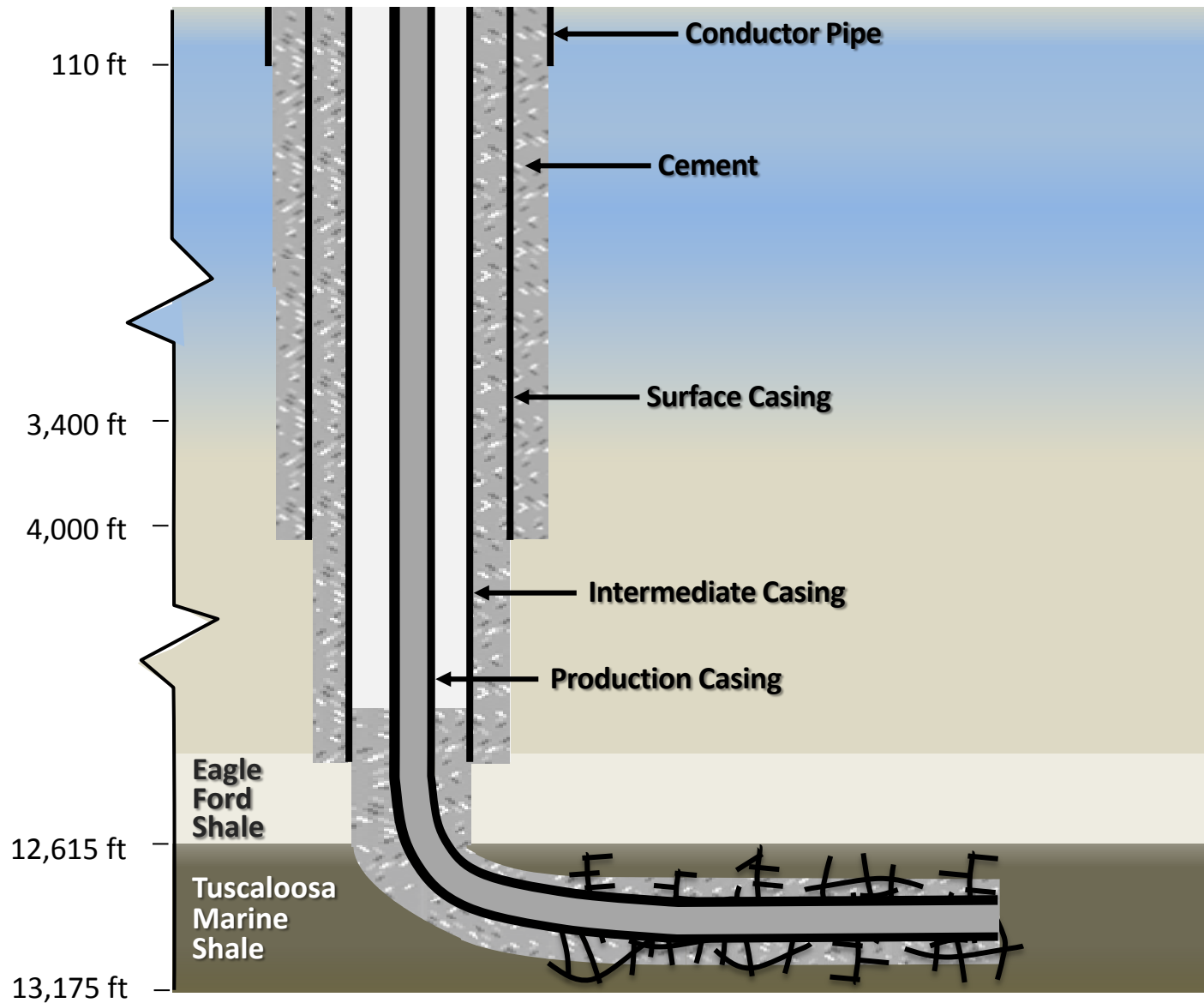
Depths of Water Wells Within a 2-mile Radius



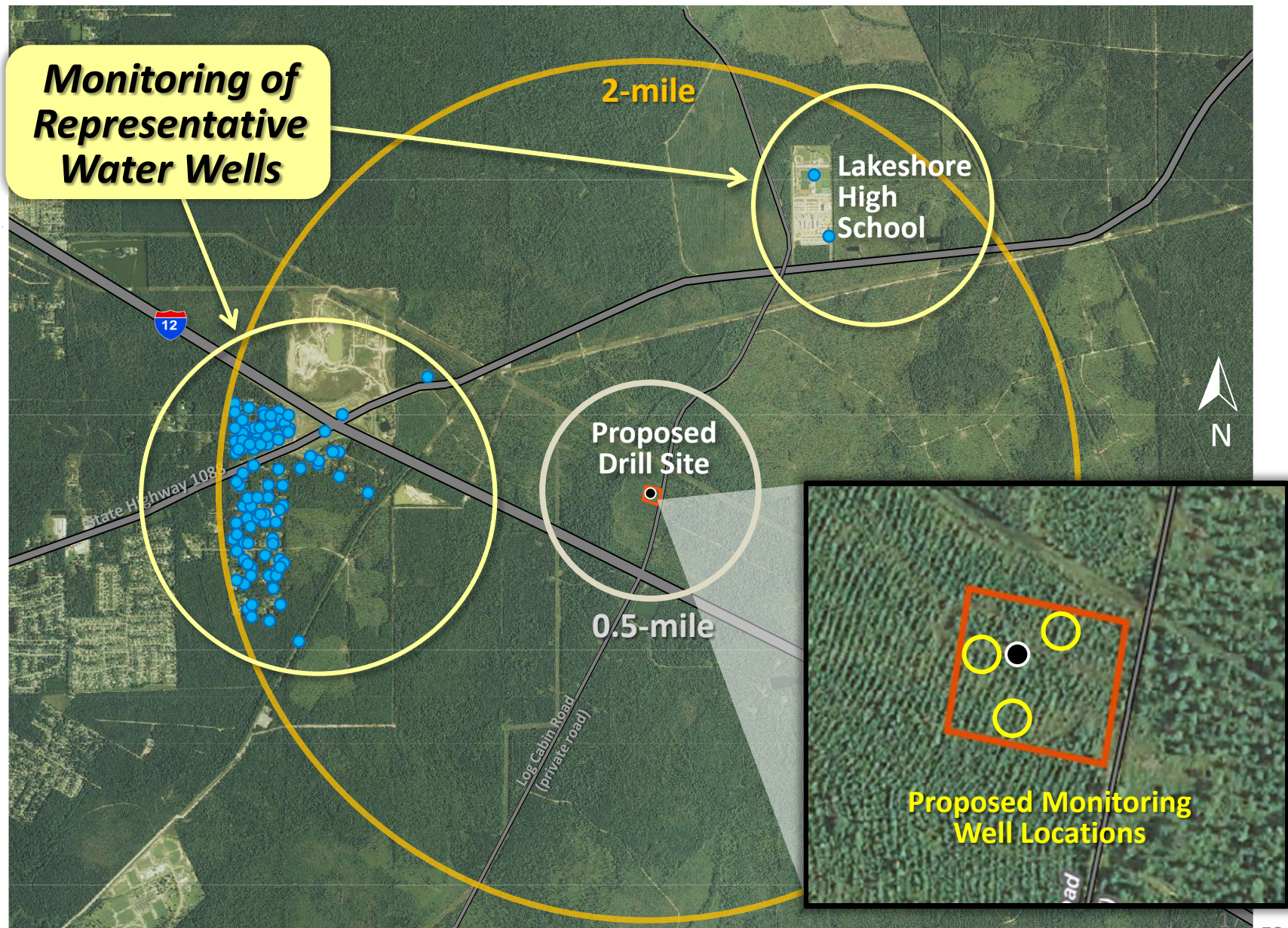
Concerns Regarding Soil/Groundwater Impacts: Uncontrolled Fracture Propagation



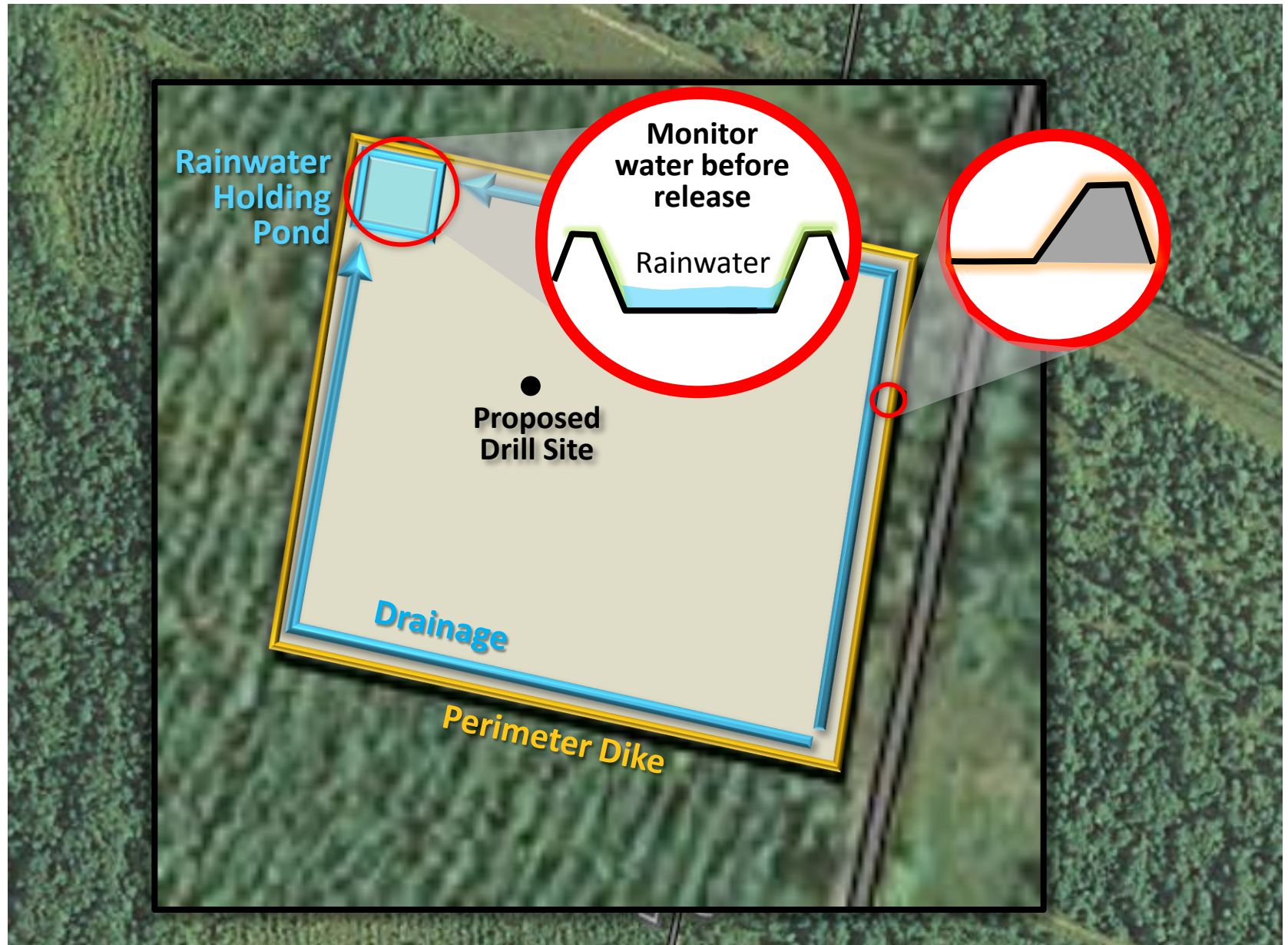
How Will Helis Construct This Well to Protect Groundwater?



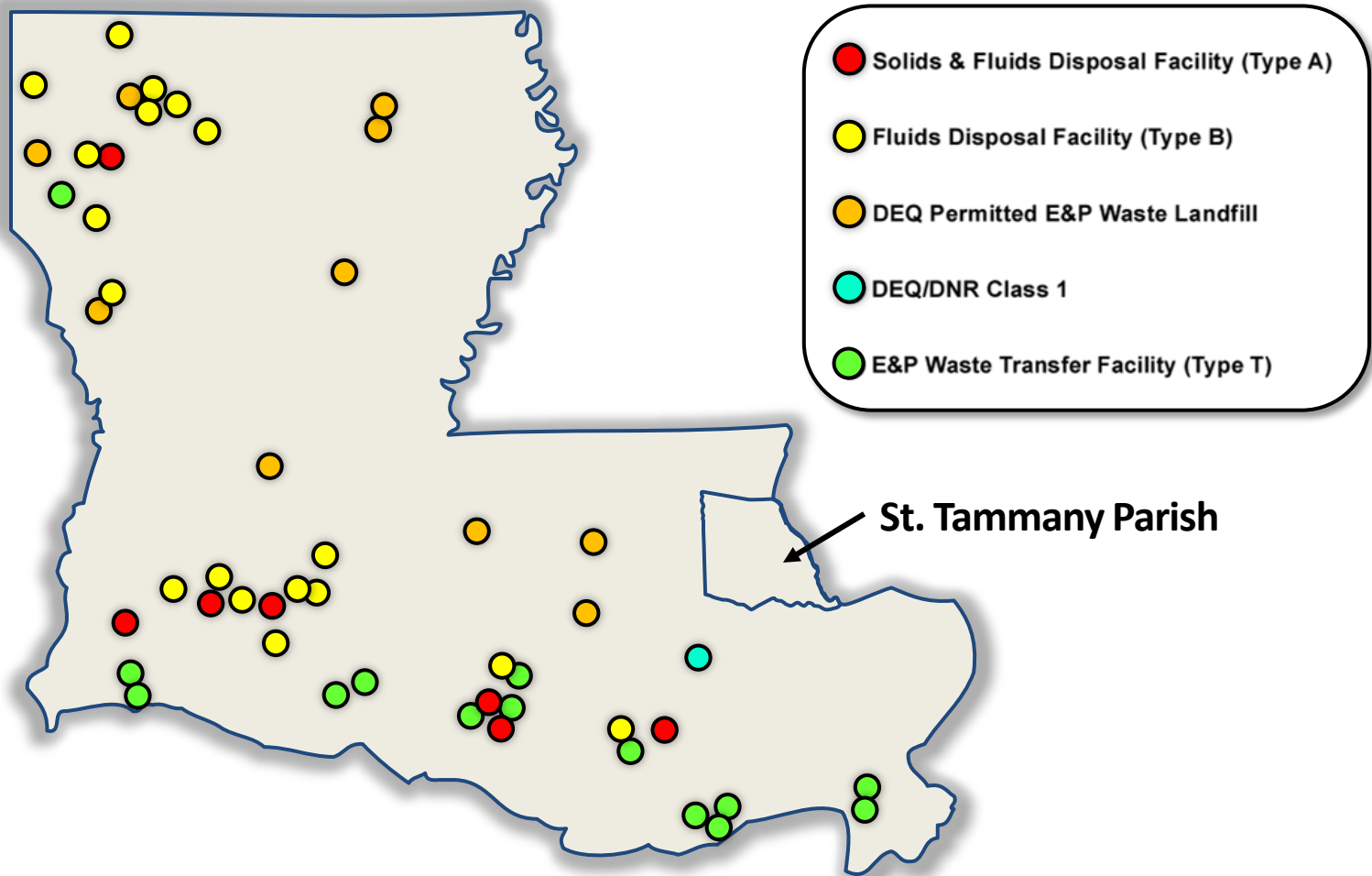
Groundwater Monitoring Plan



Stormwater Management

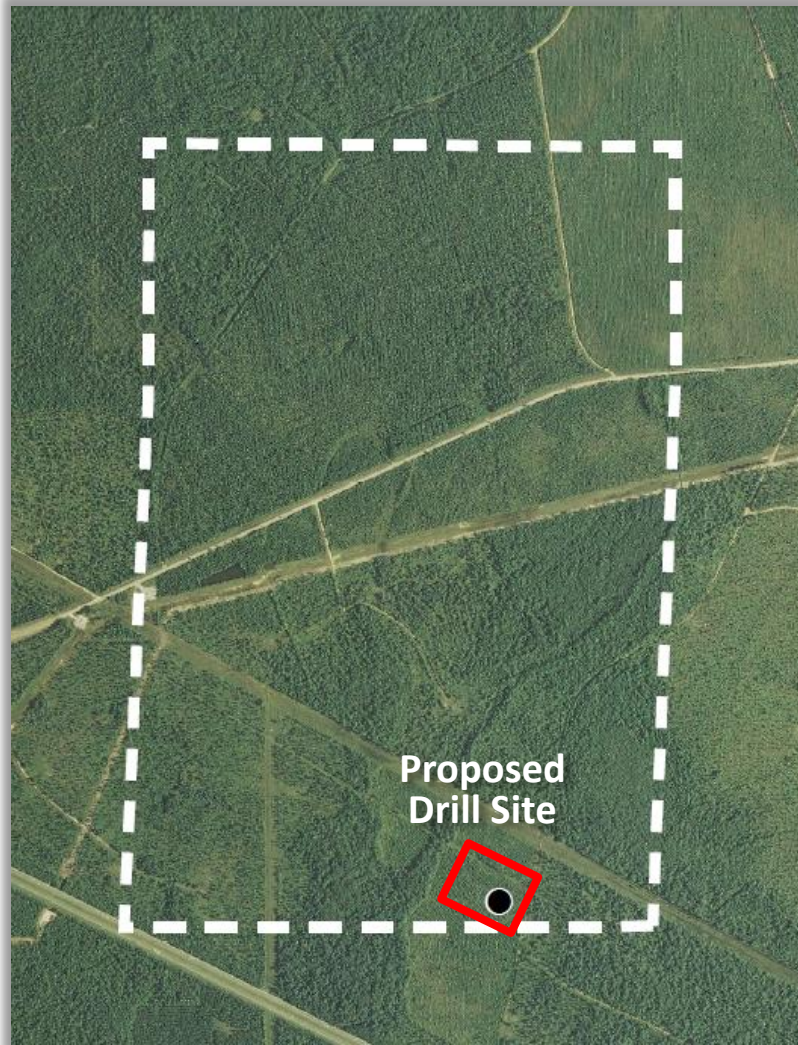


Disposal Sites in Louisiana



**Solids and liquids will be transported out
of St. Tammany Parish**

Wetlands – Permit & Siting Considerations



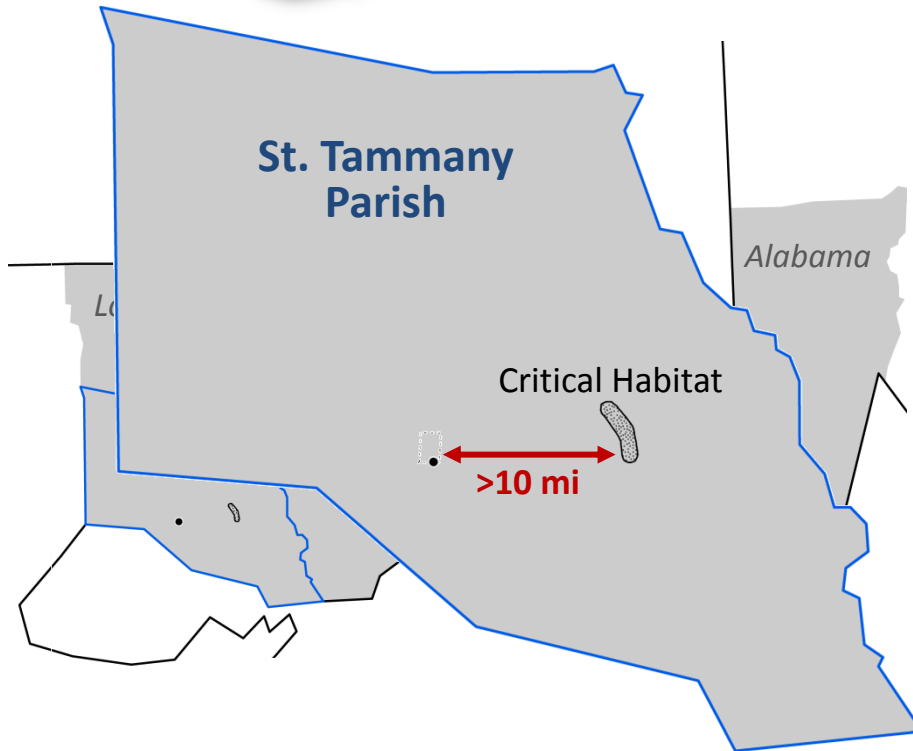
- Minimize impact to wetlands and critical habitats
- Minimize construction
- Maximize distance from local population
- Outside of Coastal Zone
- Target geological formation

**Reviewed by LDEQ, USACE,
LWF, and USEPA.**

**LA Geological Survey: *no
less damaging feasible
alternatives.***

Threatened & Endangered Species

Dusky Gopher Frog



- **Critical habitat designated in St. Tammany Parish is over 10 miles from proposed site.**

SOURCE: Federal Register Vol. 77, No. 113. Tuesday, June 12, 2012, Rules and Regulations.
The Nature Conservancy, 2014, Dusky Gopher Frog Profile.

Additional Issues/Proposed Plans

Issues

Considered in Helis' Plans?

- Considerations for site selection
- Groundwater protection
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